

Subd 1 5

WHAT IS CLAIMED IS:

1. An exposure apparatus that exposes a pattern onto a substrate, the exposure apparatus comprising:
 - a projection system to project the pattern onto the substrate;
 - a holder connected to the projection system to hold the projection system;
 - a detector to detect information concerning displacement of the projection system;
 - an actuator arranged on the holder; and
 - a driver connected to the actuator to drive the actuator in response to detection results of the detector.
- 10 2. The exposure apparatus of claim 1, wherein the actuator includes piezoelectric elements.
3. The exposure apparatus of claim 1, wherein the detector is arranged on at least one of the projection system and the holder.
4. The exposure apparatus of claim 1, wherein the detector includes an acceleration sensor.
5. The exposure apparatus of claim 1, wherein the detector includes a distortion sensor.
6. The exposure apparatus of claim 1, wherein the detector is arranged in a vicinity of the holder.
7. The exposure apparatus of claim 1, wherein the actuator is arranged in a vicinity of a relatively weak part of the holder.
8. The exposure apparatus of claim 1, further comprising:
 - 25 a mask stage that holds and moves a mask having the pattern; and
 - a substrate stage that holds and moves the substrate; wherein
 - the mask stage, the substrate stage and the projection system are independently arranged so that they vibrate independently of each other.
9. The exposure apparatus of claim 1, wherein the detector includes an acceleration sensor mounted to the projection system and a distortion sensor mounted to the holder.
- 30 10. The exposure apparatus of claim 1, wherein the actuator is mounted on an adapter plate that is releasably attached to the holder.

11. The exposure apparatus of claim 1, wherein the projection system is a projection optical system.

12. The exposure apparatus of claim 1, further comprising:
a main frame and an object stage that holds and moves an object; and
wherein the holder and the object stage are mounted to the main frame.

13. The exposure apparatus of claim 12, wherein:
the object stage includes a drive system that moves the object, the object stage drive system including a movable part that moves with the object, and a stationary part that is coupled to the main frame; and
10 the exposure apparatus further comprising a compensatory driving system that applies a compensatory force to the stationary part of the object stage drive system.

14. The exposure apparatus of claim 13, wherein the object is a substrate onto which the pattern is projected by the projection system, and the object stage is a substrate stage that holds and moves the substrate.

15. The exposure apparatus of claim 14, wherein the exposure apparatus is a scanning exposure apparatus, and the drive system of the substrate stage moves the substrate stage while the pattern is projected onto the substrate.

16. The exposure apparatus of claim 13, wherein the object is a reticle that contains the pattern that is projected by the projection system, and the object stage is a reticle stage that holds and moves the reticle.

17. The exposure apparatus of claim 16, wherein the exposure apparatus is a scanning exposure apparatus, and the drive system of the reticle stage moves the reticle stage while the pattern is projected by the projection system.

18. A method of making an exposure apparatus that exposes a pattern onto a substrate, the method comprising:

providing a projection system to project the pattern onto the substrate;
providing a holder connected to the projection system to hold the projection system;
providing a detector to detect information concerning displacement of the projection system;
providing an actuator on the holder; and

providing a driver connected to the actuator to drive the actuator in response to detection results of the detector.

19. The method of claim 18, wherein the actuator includes piezoelectric elements.

20. The method of claim 18, wherein the detector is arranged on at least one of the 5 projection system and the holder.

21. The method of claim 18, wherein the detector includes an acceleration sensor.

22. The method of claim 18, wherein the detector includes a distortion sensor.

23. The method of claim 18, wherein the detector is arranged in a vicinity of the holder.

10 24. The method of claim 18, wherein the actuator is arranged in a vicinity of a relatively weak part of the holder.

25. The method of claim 18, further comprising:

providing a mask stage that holds and moves a mask having the pattern; and

providing a substrate stage that holds and moves the substrate; wherein

15 the mask stage, the substrate stage and the projection system are independently arranged so that they vibrate independently of each other.

26. The method of claim 18, further comprising mounting the actuator on an adapter plate that is releasably attached to the holder.

27. The method of claim 18, further comprising:

providing a main frame; and

providing an object stage that holds and moves an object; and

mounting the holder and the object stage to the main frame.

28. The method of claim 27, wherein the object is a substrate onto which the 25 pattern is projected by the projection system, and the object stage is a substrate stage that holds and moves the substrate.

29. The method of claim 27, wherein the object is a reticle that contains the pattern that is projected by the projection system, and the object stage is a reticle stage that holds and moves the reticle.

30. A method of exposing a pattern onto a substrate, the method comprising:

projecting the pattern onto the substrate with a projection system;

holding the projection system with a holder;

detecting information concerning displacement of the projection system; and

driving an actuator mounted on the holder in response to the detected information.

31. The method of claim 30, wherein the actuator includes piezoelectric elements.

5 32. The method of claim 30, wherein the information concerning displacement of the projection system is detected by a detector arranged on at least one of the projection system and the holder.

33. The method of claim 30, wherein the information concerning displacement of the projection system is detected by an acceleration sensor.

10 34. The method of claim 30, wherein the information concerning displacement of the projection system is detected by a distortion sensor.

35. The method of claim 30, wherein the information concerning displacement of the projection system is detected by a detector arranged in a vicinity of the holder.

36. The method of claim 30, wherein the actuator is arranged in a vicinity of a relatively weak part of the holder.

37. The method of claim 30, further comprising:

moving a mask having the pattern with a mask stage; and

holding and moving the substrate with a substrate stage; wherein

the mask stage, the substrate stage and the projection system are independently arranged so that they vibrate independently of each other.

20 38. The method of claim 30, wherein the actuator is mounted on an adapter plate that is releasably attached to the holder.

39. The method of claim 30, further comprising:

holding and moving an object with an object stage; and

mounting the holder and the object stage to a main frame.

25 40. The method of claim 39, wherein the object is a substrate onto which the pattern is projected by the projection system, and the object stage is a substrate stage that holds and moves the substrate.

30 41. The method of claim 39, wherein the object is a reticle that contains the pattern that is projected by the projection system, and the object stage is a reticle stage that holds and moves the reticle.